REMARKS

This is a response to the Office Action mailed on 22 May 2003. Claims 1 – 14 were rejected. Claims 1 and 12 have been amended. Claim 4 has been canceled Claims 1 – 3 and 5 - 14 remain for consideration.

In ¶¶ 2 – 3, Examiner rejected claims 11 and 12 under 35 U.S.C. § 112, 2nd ¶ for allegedly failing to particularly point out and distinctly claim the subject matter Applicants regard as the invention. Specifically, Examiner referred to language at (i) claim 12, line 4 "and in any event less than about 0.002" as unclear as to whether the 0.02 was in weight percent, and whether zirconium could be added in an amount not more than 0.02; (ii) claim 12, line 6 the basis for the range for the sum of aluminum and titanium was not clear, and (iii) claim, 11 line 2 and claim 12 line 8, the use of "2.5X" and "2.4X" was unclear.

In response to (i), claim 12 has been amended to clarify that the 0.02 is weight percent (as are the other elements – see claim 12, line 2). As to whether zirconium could be added, Applicants note the language at line 4 that there is "no intentional addition" of zirconium, i.e., rather than intentionally adding zirconium, the presence of zirconium less than about 0.02 % can be tolerated, and as also noted in the specification there is preferably little or no zirconium.

In response to (ii), Applicants have amended the sum of aluminum and titanium in claim 12 to correspond to the aluminum and titanium contents also set forth in that claim.

In response to (iii), Applicants note that the oxidation resistance at 2000 F, and creep rupture life at 1400 F, of the present invention are about two and a half times greater than the oxidation resistance and two point four times greater than the creep rupture life of an alloy

having the nominal composition listed at the end of claims 11 and 12 (14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C bal Ni). See also ¶¶ 36 and 37 in the application. In light of the content of the specification and the above remarks, Applicants respectfully submit that there is no need to amend the claim language.

In ¶¶ 4 – 5, Examiner rejected claims 1 - 14 under 35 U.S.C. § 103 as allegedly unpatentable over U.S. Pat. Nos. 4,597,809 to Duhl et al. and 3,619,182 to Bieber et al. Applicants respectfully traverse the rejection.

Duhl '809 discloses high strength hot corrosion resistant single crystals containing tantalum carbide. At col. 3, lines 35 – 40 Duhl references an alloy containing in wt. % 11.8 Cr, 4 W, 5.1 Ta, 3.7Al, 4.2 Ti, 9 Co, 1.96 Mo, 0.07 C bal. Ni, and there is reference to about 0.4 – 1.5 vol. % of TaC type particles. Applicants submit that Duhl is not (as the Examiner suggests) silent as to directional solidification – the specification and claims are replete with references to single crystal (not columnar grain, e.g., directionally solidified and having more than one crystal) articles.

There is no boron or zirconium content specified in Duhl (although boron - as a melting point depressant – is typically minimized or eliminated in single crystal alloys). Duhl also indicates that the '809 alloy was based on IN 792 but was different, e.g., it included other elements, carbon, additional tantalum, etc. – and thus the Duhl alloy is *not* (as Examiner suggests on page 4 of the Action) the IN792 alloy.

There is no reference to oxidation resistance. There is no suggestion that the '809 alloy would be useful in directionally solidified form having more than one crystal, or if so whether

and how the composition should be modified. There is no reference to either oxidation resistance or creep rupture life relative to a corresponding alloy nominally comprising 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C bal Ni.

Bieber at col. 2, lines 22 – 42 discloses a cast nickel base alloy (given the time the patent issued presumably an equiaxed casting) in weight percent including 9.5 – 14 chromium; 7 – 11 cobalt; 1 – 2.5 molybdenum; 3 – 6 tungsten; 1 – 4 tantalum; 3 – 4 aluminum; 3 – 5 titanium; Al + Ti 6.5 – 8; 0.005 – 0.05 boron; 0.01 – 0.25 zirconium; 0.02 – 0.225 carbon; balance nickel.

Applicants submit that one skilled in the art would not mix and match the single crystal Duhl alloy with the equiaxed (given the 1968 filing date of the) Bieber alloy. The tantalum content of Bieber (1 – 4 wt. %) is lower than and outside of the present invention (4.5 – 6 wt. %). Were one to combine Bieber and Duhl anyway, it is not clear which range of tantalum one would select to achieve success – or if success were even possible. While there is reference to rupture life (col. 3, lines 29 – 33) there is no reference to creep rupture life relative to a corresponding alloy nominally comprising 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C bal Ni. While there is reference to "good" oxidation resistance (col. 4, lines 55 – 75), there is no reference to oxidation resistance relative to a corresponding alloy nominally comprising 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C bal Ni. There is no suggestion that the Bieber alloy is useful as a directionally solidified (columnar grain) article, or if so whether and how the composition should be modified.

Applicants submit that there is no teaching, suggestion or motivation to combine these references, even if combined the combined alloy would fail to teach several aspects of the inventive alloy, and there is no reasonable expectation of success were the Duhl and Bieber alloy teachings combined.

As is known in the art, alloys - single crystal or equiaxed or other form - are typically tailored to achieve certain properties in a given form, and single crystal and equiaxed teachings are not interchangeable with one another. One looking to alter a single crystal alloy into a columnar grain/directionally solidified alloy would not look to the art of equiaxed alloys; and one looking to alter an equiaxed alloy into a columnar grain/directionally solidified alloy would not look to the art of single crystal alloys. For example, and with reference to paragraph [011] of the present application, one looking to convert a single crystal alloy into columnar grain, or an equiaxed alloy into columnar grain, would add hafnium, carbon, boron and zirconium to improve mechanical properties measured across grain boundaries, such as transverse creep strength and/or ductility.

In contrast, the present invention has no intentional additions of hafnium or zirconium. The present invention shows an unexpected increase in oxidation resistance over other highly corrosion resistant alloys. It has been determined that low hafnium content is critical and must be minimized to maintain this excellent oxidation resistance, and thus the no intentional addition of hafnium. Also, and as noted in ¶ 33 of the specification, some zirconium can be tolerated but is preferably below some low, maximum level or is eliminated – and that this is important to obtaining good castings. Relative to the '809 single crystal alloy, the present alloy has no additional carbon, and little if any boron. Relative to the equiaxed '182 alloy, the

present alloy includes equal or less boron, and equal or less carbon. Accordingly, the inventive alloy is not taught by the Duhl and Bieber referencces, but rather teaches away from what one skilled in the art would try when converting either a single crystal alloy into a columnar grain alloy, or an equiaxed alloy into a columnar grain alloy.

In addition, it is non-obvious what levels of the grain boundary strengthening elements, carbon, boron, zirconium and hafnium must be added to a single crystal alloy to achieve both adequate grain boundary mechanical properties and ductility and achieve crack-free castings. The current invention teaches that it is critical that no intentional addition of zirconium be made and that an optimum combination of carbon and boron were necessary to prevent grain boundary cracking during casting. It is also surprising and noteworthy that no addition of hafnium was required to achieve this outstanding combination of mechanical properties and castability.

With respect to the Examiner's comments at page 4 of the Action, Applicants note that the Duhl'809 alloy is <u>not</u> the IN792 alloy as suggested by the Examiner, and this is noted both in the Duhl patent and in the remarks above. With respect to the directional solidified limitation, Applicants have canceled claim 4 and amended claim 1 to clarify the use of directional solidification, e.g., columnar grain with more than one crystal. Moreover, given the compositional variations between the inventive alloy and Duhl (and/or Bieber or the combination), coupled with the different form (single crystal vs. columnar grain – having more than one crystal), and the exceptional properties of the inventive alloy vs. either the

Duhl alloy or the Bieber alloy (IN792). Applicants submit that Examiner's observations regarding the "properties of the last three lines of applicant's' claim1" are not appropriate.

Applicants petition for a three month extension of time to tile this response. Please charge our Deposit Account No. 21-0279 in the amount of $930. for the petition fee.

Applicants believe that there are no other fees due for submitting this response.

For at least the foregoing reasons, Applicants submit that the independent claims 1 and 12 and their respective dependent claims are allowable over the prior art of record. The Examiner is invited to contact the undersigned if there are any questions.

Respectfully submitted,

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